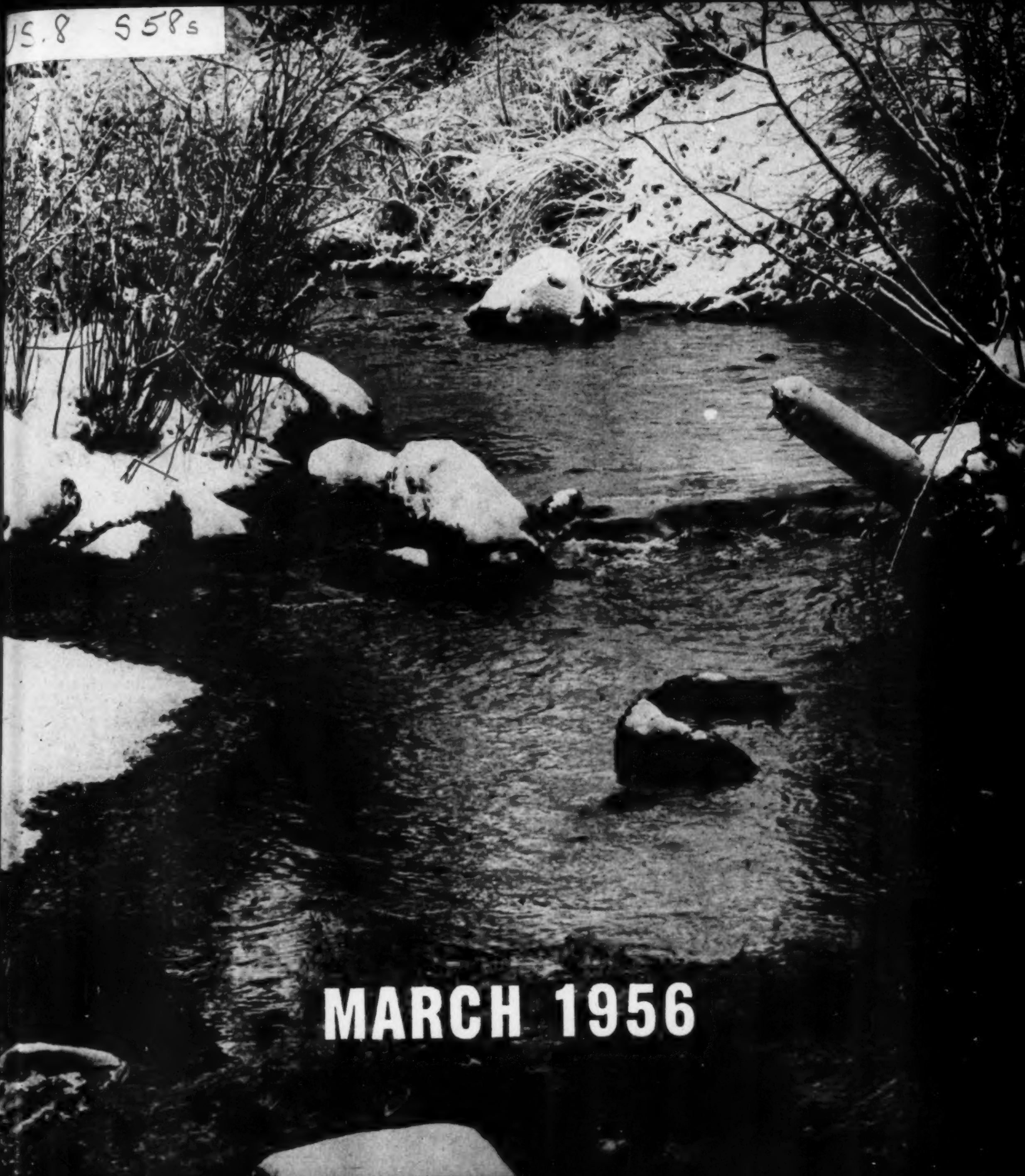

MARCH 1956

SOIL CONSERVATION

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SOIL CONSERVATION

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EZRA TAFT BENSON
SECRETARY OF AGRICULTURE

DONALD A. WILLIAMS
ADMINISTRATOR, SOIL CONSERVATION SERVICE

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

★ THIS MONTH ★

SOIL CONSERVATION is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business. The printing of this publication has been approved by the Bureau of the Budget, July 18, 1955. SOIL CONSERVATION supplies information for workers of the Department of Agriculture and others engaged in soil conservation.

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OUR SOIL ★ OUR STRENGTH

WHY WATER IS PRECIOUS.—Would you believe that every cutting of alfalfa requires about 326,000 gallons of water per acre to grow it? Or that an acre of cotton needs 800,000 gallons of water to mature one annual crop?

In other ways, too, our consumption of water is staggering: A large paper mill requires 50 million gallons of water per day—more than enough to supply the day's personal needs for a city of half a million. It takes from 600 to 1,000 times as much water as coal to operate a steam power generating plant. It takes 18 barrels of water to produce a barrel of oil, 25 gallons of water to produce a gallon of aviation gas, 250 tons of water to make a ton of steel or a ton of sulfate wood pulp. It takes 42 gallons of water to produce a pound of rubber, and 1,000 gallons of water are required to produce a pound of rayon. Finally, in the United States the average use of water per citizen—for industrial, personal, and other needs—is about 1,300 gallons daily —and the total is rising all the time.

Such facts show why farmers and urbanites alike are interested in protecting water resources and using water efficiently.

FRONT COVER.—The spring thaw at the headwaters of Salmon Falls Creek, Idaho releases much precious water to the people in the valleys below.

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Peaches Prosper

By WAYNE D. JACKSON and FRED W. HERBERT

A building contractor retires to become an orchardist. By using common sense combined with past experience and with technical aid from his soil conservation district he rejuvenates an old peach orchard and makes it pay good dividends.

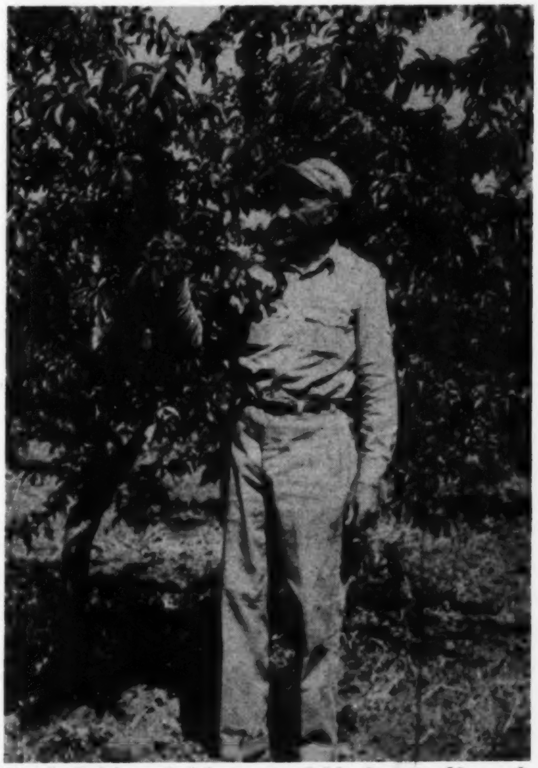
FRANK A. POIRIER was formerly a building contractor. In 1949 he retired and purchased 78 acres on the Horseshoe Bar Road, 3½ miles east of Loomis, Calif. The fact that he had not previously engaged in farming is "fortunate," he says, "because I had nothing to unlearn and no fixed notions."

Most of the 78 acres was in bad shape. Part was covered with native brush while some was very wet and covered with willows and wild berries. Production was much below the county average. The cultivated part was an orchard that contained 28 varieties of fruit trees, planted at random throughout the orchard.

While he had some ideas of his own, Poirier knew he needed help. He heard about the Placer County Soil Conservation District and applied to that district for assistance.

Through the district, a soil conservation survey was made of his acreage. The survey showed that most of the soil was light textured and from 36 to 60 inches deep, underlain with granite. The slopes were from 3 to 12 percent. Most of the land was Class II or III and had suffered considerable erosion. Some areas were too wet for fruit trees. He and the Soil Conservation Service technicians decided that peaches could be grown successfully with suitable soil conservation practices, especially adequate drainage and irrigation. As a newcomer to the farming business, the land capability survey showing the needs, limitations, and possibilities of his farm greatly impressed Poirier. He feels that this was fundamental to all his subsequent operations.

The first job for Poirier was to clear 23 acres of brush and wild berries, and to bulldoze out most of the old trees. Then he started to plant his new orchard. He had one strong conviction: That drainage was his No. 1 problem. Typical of his attitude and actions in all of his farming operations, he did a thorough drainage job. He installed 7,500 feet of closed tile drainpipe. This was laid so that much of the water drains into a sump at the lower end of the orchard to be pumped back onto the orchard for irrigation. Having arranged for thorough drainage, Poirier next planned to irrigate by sprinklers. In developing his sprinkler system, he experimented with methods of getting water under the trees. He finally decided this could best be done by placing the sprinklers low and properly angling the nozzles.



Frank Poirier admiring one of his 3-year old peach trees.

Note.—The authors, both with Soil Conservation Service, are respectively, work unit conservationist, Auburn, Calif. and assistant state conservationist, Berkeley, Calif.

Linda Poirier (left) and cousin Tina sample Elberta peaches.

Next came a planned system of cover cropping and fertilizing. He purchased a soil testing kit to determine the general level of fertility, particularly the needs for nitrogen and phosphorous. Early in his fertilizing program, he found that 39 pounds of nitrate per acre-foot of water was coming out in the drain water.

He finally settled on about one-third pound of actual nitrates per tree per year, to be increased as the trees grew larger. Superphosphate (19% P_2O_5) was applied at the rate of 200 pounds per acre to the cover crop. He also applied 500 pounds of lime per acre the second year. In 1955 the nitrate fertilizer was applied in three separate applications to help overcome the nitrate loss through the drainage water. He applied 1 pound of actual nitrate per tree. This was applied by using 1/3 pound of actual nitrate per tree using ammonium nitrate; another 1/3 pound per tree was applied in 30 days using Urea fertilizer. The last application was made 30 days later, using Urea. Then he decided to grow an annual cover crop of Canadian field peas and barley to supplement the commercial fertilizer, as well as to guard against erosion by winter rains and to improve the condition of the soil. He discs the cover crop into the upper layer of the soil at the end of the rainy season each spring.

Mr. Poirier is now experimenting with pruning. His idea is to not prune the pendulous branches that hang down to form the "skirt" of the tree. These are removed under the conventional pruning system. He feels that these branches provide an increased fruiting area that can be utilized if the trees are properly fertilized and irrigated. By proper thinning of the fruit, the weight of the fruit can be distributed without danger of breaking lateral branches.

In August of 1953, 2.3 tons of peaches were harvested from 2½-year-old trees. In 1954, 6.7 tons were harvested from 3½-year-old trees. In 1955, a late spring frost greatly reduced the "set" of fruit, but the orchard is in splendid condition and, in size, the trees appear to be twice their age. The possibilities of ultimate yields are indicated by the production from a three-acre block of old Elberta trees which Mr. Poirier left when the rest of the old orchard was dozed out. These trees have received the same treatment given the young orchard. They are averaging 18 tons of peaches per acre.

Fork lift pickup loads 1 ton, 42 boxes, of Elberta peaches on bank-out trailer.

Poirier has applied efficient methods learned in the contracting business in the harvest of his peach crop. He uses a bank-out trailer along with matts and a fork lift in bringing the peaches in from the field and stacking them to

Tractor tows trailer with 1 ton of peaches to shipping station.

await the arrival of large semitrailer trucks to transport the fruit to the canneries where they are sold.

Since his 1955 experience Poirier has laid in a supply of 5-gallon paint cans that he bought for 10 cents each, which he plans to use for smudge pots in the event of another frost.

Since it takes several years to make a producing orchard, most growers are, perhaps, unable to wipe out an entire old orchard and start over. The soil and water conservation principles and practices which Poirier used to secure top production, however, can be applied on smaller areas each year. By doing this with a coordinated soil and water conservation plan in mind, any farmer with comparable conditions can achieve much the same results.

Poirier's experience in the highly competitive contracting business, made him very receptive to the principles of conservation farming. He is carrying out these principles by conserving plant nutrients, in applying the right amounts of fertilizer, by draining the wet lands, protecting his sloping land against erosion by cover cropping, and conserving water by installing a system for impounding excess irrigation water for reapplication to the land. His whole farming operation is characterized by his placing primary emphasis on determining the needs of the trees, then applying the best known methods to supply those needs.

Water Spreading Pays Off

Nebraska ranchers find that ponds and water sperading structures conserve both water and soil and improve their ranges.

By A. RALPH GRENIER

IN the northwest corner of Nebraska there is an area known as the Gumbo, the soils being heavy clays developed from Pierre shales. Some of this land is in the Sugarloaf Soil Conservation District which was organized in April 1941. Before that the Federal Government had a submarginal land purchase program, the Pine Ridge Land Utilization Project. After the district was organized in 1941, the district board of supervisors took over the grazing management of the Government-owned lands. This land has since been used exclusively for grazing. The board of supervisors accepts grazing applications each spring and allots the grazing permits to eligible lessees. Although the U. S. Forest Service took over the management of the Government lands from the Soil Conservation Service in 1954, the Sugarloaf Soil Conservation District Board of Supervisors still has the responsibility for alloting grazing permits and collection of grazing fees.

At the time the district was organized in 1941, the main jobs confronting the board of supervisors were building dams for stock water to get better use of the rangelands and increasing the growth of hay for winter feed on the ranches.

There is practically no water available from wells either for livestock or human use. Most people catch rainwater from the roofs of their homes and run it into cisterns for human consumption. But supplying livestock water presented a different problem. Building properly

Note.—The author is work unit conservationist, Soil Conservation Service, Fort Robinson, Nebr.

Diversion canal to lead water to Henry and Mader ranches.

designed stock water dams of adequate size and at the right location seemed to be the only practical solution to this problem on both private and Government-owned lands. SCS technicians have designed, laid out, and supervised the construction of approximately 280 dams on private lands and 140 on Government-owned lands.

The problem of increasing winter feed supplies by raising more hay crops was almost as important as the livestock water problem. The annual precipitation is around 15 to 17 inches. This amount of moisture will grow good summer feed such as native grasses, but will seldom produce good hay crops such as alfalfa. The only feasible solution to this problem was to use flood runoff waters for the production of hay and feed crops. SCS technicians laid out water-spreading systems on suitable fields that had adequate runoff areas above them to make them function properly. Several large irrigation storage dams were built to catch floodwaters and irrigate lower-lying areas which had been allocated for hay production.

Water spreading proved to be one of the most popular mechanical practices installed in the district. These systems fall into three different types—wild flooding from contour ditches, contour dikes with drain gates to drain off excess water and prevent damage to hay, and controlled irrigation from storage dams.

One of the most extensive water-spreading systems was installed during the winter of 1953 and 1954 to irrigate more than 700 acres for hay production on the Mader and Henry ranches.

During the dry summer of 1953, Jerome and Merlin Mader kept thinking and talking about all the good water that went down Indian Creek during the spring runoff and heavy intermittent rains. They finally decided that maybe something could be done with the water. Indian Creek has a drainage area extending about 40 miles into Wyoming and South Dakota. Jerome operates the H. I. Mader ranch and Merlin operates the J. L. Henry ranch. These ranches are located about 40 miles northwest of Crawford, Nebr., on the Nebraska-South Dakota line.

The Mader ranch has had a conservation ranch plan with the Sugarloaf Soil Conservation District since 1943 and during the period two large storage dams were built on dry draws for irrigation. These dams are near each other and the overflow trickle ditch from the larger dam empties into the smaller dam. These two dams impound 250 acre feet of storage. During the recent dry years, however, these dams have not been filling to capacity.

The Henry ranch has had a conservation ranch plan with the Sugarloaf Soil Conservation District since 1942. It has an inadequate

Concrete control structure where water is derived from Indian Creek.

storage system consisting of two reservoirs which occasionally were filled from runoff coming down from dry draws. Even in the years that these reservoirs filled there was insufficient water to irrigate all the nearly level land below which Henry owns.

In August 1953, Jerome and Merlin decided to see what the Soil Conservation District and SCS technicians could do to help solve their water problems.

A preliminary survey to determine the feasibility of placing additional land under a water-spreading system was made by A. Ralph Grenier and John Mader of the local SCS office. A feasible solution and plan were worked out.

The completion of this project is an example of cooperation and hard work put together by the 2 landowners, 2 tenants, their local Soil Conservation District, and the SCS technicians.

After a number of meetings of landowners, their tenants, and the SCS technicians and the development of a pooling agreement through the Agricultural Conservation Program, a management and operations plan was agreed upon by the landowners. The SCS engineer completed the design for the project and the local SCS technicians staked and supervised construction of the project.

A contract was let for the major earth moving jobs. Work began on November 10, 1953, and was completed on February 26, 1954.

The project consisted of building a 4½-mile long ditch which is 10 feet wide at the bottom and varies in depth from 2 to 24 feet. This involved moving approximately 85,000 cubic yards of dirt.

This ditch takes water from Indian Creek through a concrete control structure 6 feet high and 10 feet wide placed in the diversion canal. The canal has a capacity of 36 second-feet.

Contractor Emil Kilber of Chadron, Nebr., did the dirt moving job and the Maders and Henry and son, Gail, laid 196 feet of 24-inch concrete pipe for road crossings, lateral turnouts, and a let down structure. In addition they used 200 feet of 12-inch concrete pipe for outlets and turnouts. All outlets are gated. A number of the outlets were placed so as to also serve the purpose of silt removal. Fourteen cubic yards of concrete were poured in the inlet structure.

The ditch spreads water on approximately

J. L. Henry (left) and H. I. Mader congratulating each other on completion of their joint water diversion and water spreading project.

300 acres of the J. L. Henry ranch and 36 acres on the H. I. Mader ranch before the ditch empties into 2 storage dams on the Mader ranch.

Some of the land on both ranches is being leveled and bordered. The nearly level heavy soils are contour diked and flooded. The steeper areas are contour flooded with corrugations for more uniform spread of the water.

Alfalfa is used for the main hay crop and is also drilled into the sod where the land is not leveled and bordered. When irrigation water is applied, the native short grasses, cactus, and sagebrush fade out and the vegetation becomes principally western wheatgrass and green needlegrass along with the alfalfa. The areas in alfalfa before the development of this project were yielding around 1 ton to the acre. In 1955 the first cutting of hay made 2 tons or better.

Henry and Mader always wondered if this type of project could be developed when they were operating these ranches. They have both said since completing the project that it is wonderful to be able to use more of the water that flows down Indian Creek when the creek is up.

This project has been watched closely by other landowners in the district. There is now another project of a similar type being contemplated for development in the near future.

LOANS UNDERWAY.—During the first 7 months of the Farmers Home Administration's new soil and water conservation program, 2,195 farmers and ranchers borrowed $11,881,000 to improve soil and water resources.

A Look at Erosion Under Furrow Irrigation

No. 13

This is the thirteenth of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.

By STEPHEN J. MECH

EROSION control is basic to sustained production. Keep the soil in place and the problem of maintaining its productivity will be greatly simplified. In other words, it is easier to make a living on a farm with 14 inches of topsoil than on one where 8 have been washed away and only 6 remain. The deeper soil should produce higher yields with less effort and expense. It is easier to plow and requires less water to irrigate. It should require less fertilizer, and be easier to cultivate. The only increased cost should be that of harvesting the greater yield, but no one objects to harvesting large crops.

Higher yields per acre rather than increased acreages are primarily responsible for America's record crop production in recent years. Our declining acreage of agricultural land and the accompanying increased production per acre have emphasized the importance of better farming methods. We have more efficient farm machinery, more effective fertilizers and insecticides, as well as improved varieties of seeds and better land use.

It is easy to attribute our record crop production to any one of the above factors. Yet those who have made careful study of the maintenance of our soil productivity conclude that over a long period, soil erosion is a more troublesome problem than soil exhaustion by depletion of fertility. It is quite obvious that the soil body itself must be maintained to get maximum benefits from the better farming practices, the efficient farm machinery, effective fertilizers, improved varieties, and so on.

Water and soil fertility are usually thought of as renewable resources; but the topsoil is only slowly renewable and, in certain cases, it is practically impossible to restore. Fertililty of the soil may be high one year and low the next. It can be modified almost at will. Our water supply may fluctuate: If it be short one year heavy precipitation the next year may renew the supply. In general the depth of the topsoil, however, is altered only in one direction—downward. Once the soil is lost it can only be regained by slow and costly processes.

Obviously we must utilize the soil for crop production. Economic considerations require also that we often use it for maximum production. But we must use it in a manner that will not destroy it. If the soil is gone the effective-

Erosion at the upper end and depositions at the lower end of irrigated furrows.

Note.—The author is irrigation engineer, soil and water conservation research branch, Agricultural Research Service, U. S. Department of Agriculture, Prosser, Wash.

This gully was caused by excess tail-water from furrow-irrigated field above.

ness of many improved practices is greatly reduced and crop production becomes increasingly difficult.

There is a growing recognition that soil erosion on irrigated land is a menace to the permanence of irrigation agriculture. Dr. Israelsen in an address to the Utah State Agricultural faculty said, ". . . the permanence of agriculture in the arid regions depends vitally on more complete development of irrigation science in relation to erosion control on irrigated lands and to the solution of the alkali problem by more intelligent irrigation and drainage practice . . ."

Every acre that goes out of production means that to some degree the pressure is increased on the remaining good acres. Its production, its share of the highway, school, church, and other obligations, as well as the farm overhead must then be assumed by the remaining productive acres.

Wherever water is flowing over cultivated land it will cause erosion. If all the rainfall could be absorbed near the point where it falls there would be no runoff and no erosion. Under rainfall conditions, every effort that increases infiltration, increases the amount of rain that enters the soil, produces less runoff, and causes less erosion.

Under furrow irrigation, however, heavy erosion can take place on the upper end of an irrigation field even though there is no runoff or soil loss from the bottom. The irrigation furrow is used as a canal to deliver water to each square foot of area down the slope. The first foot of a 400-foot furrow is used as a canal to conduct at least the minimum amount of water necessary to irrigate the 399 feet below it. The point 99 feet downslope is conducting enough water to at least satisfy the thirst of the remaining 301 feet of length.

The amount of water is largest at the upper end of the run and becomes progressively less as each foot of soil absorbs its portion. Because the furrow is used as a channel for transporting water to the soil area along its length, erosion under furrow irrigation cannot be eliminated. The best we can do is reduce it to a minimum.

It is reasonable to expect that the intake need or absorption by a 400-foot furrow may change. For example, if the soil has a low absorption rate, a small amount of water applied at the top may be sufficient to irrigate the entire length. But if the "absorption" or intake of the soil is doubled, it will require more water to satisfy this greater requirement. If the rate of water application is unchanged it will be sufficient to irrigate only 200 feet. It

is obvious that the rate applied must be doubled before the entire length of the furrow is irrigated.

It is inherent in furrow irrigation that the upper part of the furrow act as a channel to supply the water required by the rest of the run. There is no satisfactory way of avoiding greater flow on the upper ends of irrigation furrows. Whether the flow required is due to a lengthening of the run or an increase in infiltration or both, does not change this fact. The water must be delivered at a rate high enough to satisfy the total infiltration demand. This means that the total infiltration rate of the entire furrow is the limiting factor below which the irrigating head cannot be satisfactorily reduced.

It is generally admitted that decreasing the flow of water will decrease erosion. Conversely, increasing the flow will increase erosion. Whether the increased flow is deliberate or accidental is immaterial. This is an unfortunate combination of circumstances because the usual good farming practices such as rotations, contouring, adding of organic matter, and other soil improving practices generally increase infiltration and thus indirectly increase the erosion hazard under furrow irrigation.

The amount of erosion depends on the rate of flow, the slope, the soil condition, crop cover, and other factors. An irrigation farmer has a certain amount of control over these things. By exercising this control properly, he can reduce erosion to a minimum.

Look at the upper end of your irrigated fields to see how much erosion is occurring on your farm. There is probably a dip in the surface not far from the head ditch or pipeline—just about where cultivation begins. This dip is usually caused by the removal of soil from this point by the water flowing in the irrigation furrows. Such losses amounting to as much as the removal of 12 inches of topsoil have been found on many relatively flat fields with short runs after about 10 years of cultivation.

Fields that show erosion at the upper end usually show sedimentation at the lower end. This gradual accumulation of soil at the lower end is caused by the deposition that takes place as the silt-laden water is absorbed into the soil. The amount of deposition reflects the amount of erosion on the upper part of the field.

Test plots for measuring erosion and flow 300, 600, and 900 feet from head ditch.

The nature of the erosion problem under irrigation may be illustrated by the following measurements made along a 900 foot irrigation furrow on a grade of 2 percent. Clear water was applied at a rate of 7 gallons per minute at the upper end of the furrow. Three hundred feet down the grade, the flow dropped to 4.5 gallons and carried a total of 176 pounds of soil past this point during the irrigation period. At a point 600 feet from the top the flow dropped to 1.9 gallons and the soil carried past the point dropped to 13 pounds. At the bottom end it dropped to 0.7 gallons a minute and only 1 pound of soil was lost from the 900-foot furrow during the entire irrgiation.

It took only 48 minutes for the water to travel the first 300 feet. It reached the 600 foot point in 3 hours and 31 minutes. It got through the entire 900 feet in 11 hours and 22 minutes. In actual practice a larger flow should be applied so that it would get through in about one fourth of the total duration of irrigation.

It seems that for similar soil and furrow conditions a flow of 4.5 gallons per minute would transport a total of 116 pounds of soil, and a flow of 1.9 gallons would carry 13 pounds regardless of what happened to the water afterwards. Whether the 4.5 gallons was used to irrigate 1,000 feet of furrow, or was entirely consumed in 100 feet, or was dropped into a waste ditch, it would still have the ability to pick up and carry away 116 pounds of soil from the area it has flowed over.

It is interesting to note that considering the 900-foot test as a whole both the runoff and the soil loss were negligible. The 0.7 gallon per minute runoff continued for only 5 hours and the entire 900-foot furrow lost only 1 pound of soil during this irrigation, yet when we look along the entire length we see that parts are subjected to severe runoff and erosion.

It becomes apparent also that erosion measurements at the bottom end furnish little information about what is occurring up the slope. The upper third of this run, for example, was irrigated with a runoff of 61 percent and lost 116 pounds of soil from each furrow.

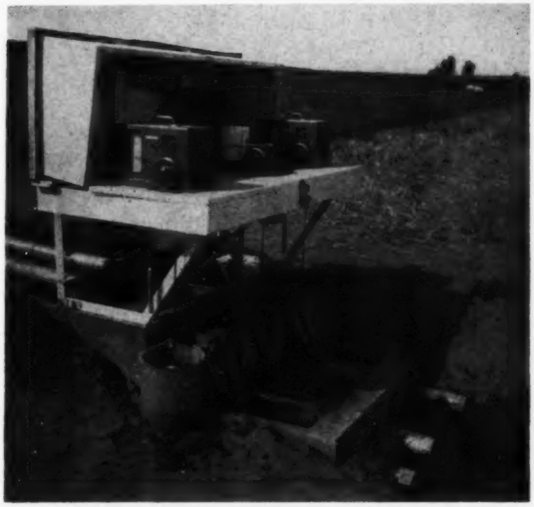
Though the application rate cannot be reduced to less than the infiltration rate of a furrow, considerable saving of soil and water can be accomplished by positive means of controlling the irrigation head such as gates and valves controlling the application to the individual furrows. Measurements on various farms have shown that in many cases as much as 70 percent of the applied water is wasted from the field. This waste water contributes nothing toward more effective irrigation. It merely moves more soil out of the furrow and may aggravate silting and drainage problems.

Cultivation and other means of stirring the soil are by far the greatest single causes of erosion. First-year alfalfa, on a 7 percent slope irrigated immediately after reditching lost 477 pounds of soil per furrow. The next irrigation, made without cultivating the furrows but using approximately the same flow, lost only 52 pounds. Third-year alfalfa on the same slope lost 250 pounds and 24 pounds for the disturbed and undisturbed furrows respectively.

The same is true in row crops. Corn lost 450 pounds of soil during the irrigation just after the last cultivation, but the following irrigation in the same furrows, untouched by tillage implements, lost only 77 pounds. The possible use of chemicals and flame for weed control has much potential value for erosion control if their use would reduce the number of required cultivations.

Vegetation in the furrow itself will hold the soil and reduce soil movement. For most effective control irrigation furrows should remain undisturbed for as long a time as possible. It is in the furrow, where the soil and flowing water contact each other, that the protection is necessary. Reditching not only loosens the soil but usually decreases the amount of vegetation at the point where it is most necessary. The condition of the area between furrows has practically no effect on the amount of erosion because it is out of reach of the flowing water.

A slight change in the cultivation schedule may reduce erosion. It is a common practice to cultivate and ditch just before irrigation. Under such conditions the irrigation water is applied in a furrow where the soil is loose and detached—a condition most susceptible to erosion. It also helps the newly disturbed weeds.



Recording machine to measure water applied and runoff from irrigation plots.

It should be much better to cultivate and ditch as far ahead of the next irrigation as possible. The disturbed weeds would be without water for quite some time and most would die. By the time of the next irrigation, the loose detached soil will have had time to settle and "firm-up." During this interval the morning dews, the showers, and even time itself tend to build up some resistance to erosion.

Erosion takes place early in the irrigation. On slopes above 2 percent practically all of the erosion takes place within 3 to 4 hours after runoff begins. If water flows for 3 to 4 hours it will in that time cause practically all the erosion damage that occurs during the entire irrigation. Permitting this stream to run on for two more days would add very little to the total erosion damage. It would, of course, affect the irrigation efficiency and aggravate the runoff and drainage problems. For example: In one experiment, corn had a total soil loss of 22.7 tons per acre during a 24-hour irrigation, but 17.3 tons of soil eroded during the first 32 minutes of flow, and all of the loss took place within 4 hours. Irrigation after the fourth hour added practically nothing to the total ero-

(Continued on page 192)

Snow Surveys Made By ... nd

By R. N. IRVING ... M. W. N

MANY ranchers and irrigators living in the Twin Falls (Idaho) Soil Conservation District know their high mountainous water producing areas in detail. They go there almost every fall to hunt deer and sagehens, they fish there in the spring, and they go there just to observe the condition of the grass and the soil. With the knowledge that these men have of their watershed, it is not surprising that they should seek help in the scientific evaluation of the snow that falls each year and the moisture status of the soil beneath it. In this way they obtain a more accurate forecast of probable water supply for the next irrigation season.

Most of those who irrigate the lowlands and graze the mountains realize the vast territory included in the watersheds of the three irrigated areas of the Twin Falls Soil Conservation District. To the west lies the Roseworth tract with a watershed of more than 125 square miles. Cedar Creek drains this area and supplies water to Cedar Mesa Reservoir which irrigates about 5,000 acres across the canyon from Castleford, Idaho. Historic Rock Creek to the east drains almost 100 square miles from the top of the Minidoka Mountains to the Snake River below.

Lying between these is the Salmon Falls tract, which is bisected by Salmon Falls Creek with its vertical lava-walled canyon, a natural barrier and one of nature's beauty spots. Recognizing no manmade state or county lines, the Salmon Falls Creek watershed reaches 9,000 feet at the top of Elk Mountain in Nevada, some 50 miles from its confluence with the Snake River 5,500 feet lower. This vast area of nearly 1,500 square miles is nature's reservoir for the snow and rain that eventually reaches the 35,000 irrigated acres of 350 farms in the valley.

Snow surveyors must travel 35 miles to the top of Magic Mountain or Deadline Ridge and more than 100 miles to Bear Creek Meadows to measure the snow courses. Usually 5 days are required the first of each month to make snow surveys for the 3 irrigated areas. They travel 370 miles by truck hauling the snow-cat, 80 miles up the mountain by snow-cat, and ski 13 more miles to the top to make snow water content and soil moisture measurements. As winter progresses, the colder weather, deteriorating road conditions, and deeper snow force them to leave the truck lower and lower on the watershed and the distances traveled by snow-cat and on skis increases.

At the request of ranchers and irrigators, the Twin Falls Soil Conservation District, and The Salmon River Canal Company, snow courses and soil moisture measuring stations were installed in the high mountains surrounding Salmon Falls Creek by the Soil Conservation Service and cooperators of the district. A net work of such courses not located within this drainage had previously provided basic data for forecasts on Salmon Falls Creek. These surveys were accurate enough for general planning, but left a great deal to be desired in the accuracy needed for detailed farm and ranch planning in Salmon Falls tract.

Individual irrigators in the area who have a sporting instinct and rugged physiques, such as Glenn Nelson, John Pastoor, Lee Bitzenburg, Eldred Taylor, Ellis Fuller, Bob Leichliter, Truman Clark, Ralph Schnell, and Elmer Farrar volunteered to take up the work of establishing the snow courses and helping make the snow surveys. These men do their work without pay or other forms of compensation, except that they get great satisfaction from doing a job they think should be done and they get information that is valuable to them in planning their farm or ranch operations for the coming season.

In July of 1954 these men along with technicians of the Soil Conservation Service established five snow courses, strategically located within the drainage area. A reconnaissance was made to determine the exact location of snow courses which would give the most consistent evaluation of each year's snow pack. Once the snow courses had been established, soil moisture units to determine the moisture content

Note.—The authors are, respectively, state conservationist and snow survey leader, Soil Conservation Service, Boise, Idaho.

nd For the Water Users

ING M. W. NELSON

of the soil beneath the snow pack were established to give more accurate data.

The soil moisture measuring units were fiber glass electrodes placed at various depths, from 6 inches to 6 feet, in undisturbed soil with wires from each unit leading through a pipe to an elevation above expected snow accumulation. The moisture in the soil is measured with a modi-

Snow surveyors of the Twin Falls Soil Conservation District measure soil moisture with an ohmmeter, (left to right) John Pastoor, Ellis Fuller, Glen Nelson, Walt Hankins.

Measuring the snow on Salmon Falls Creek watersheds: (above) taking a sample (below) weighing the snow to determine its water content.

fied ohmmeter which is attached to the lead wires.

In the winter of 1954 Walter Hankins of the Soil Conservation Service attended the Snow Surveyors' School at McCall, Idaho, for training in the precise techniques of snow surveying. When Walt returned to the Twin Falls Scil Conservation District, he was prepared to give his fellow snow surveyors scientific assistance in making accurate measurements of snow depth, water content, and moisture status of the soil.

The data gathered by these men have played a significant part in the land use planning of irrigators on the Salmon Falls tract for the last 2 years. In 1954 a water supply forecast meeting was held in April. Technicians of the Soil Conservation Service presented an interpretation of the snow survey measurements to cooperators in the Twin Falls Soil Conservation District. The snow pack was lower than had ever been recorded in the 17 years of snow measurement. The forecast predicted a low water supply for the year. The data were presented in graph form so that farmers could make their own interpretation without following the technical procedure of the multiple regression equation.

It is interesting to note that some farmers, after the meeting, came up and stated that they felt the Soil Conservation Service forecast was too high in view of the low snow pack. This proved to be the case. One of the lowest flows ever recorded on Salmon Falls Creek followed.

Many farmers prepared for this low water year by temporarily changing their land use. They cut the acreages of irrigated crops so they could concentrate the available water on bringing to maturity the crops they were going to plant. However, since this was the first year of water supply forecast made in public meetings, there were some who did not make such an interpretation.

In 1955 the same cooperative snow surveys were made on the watershed, but included 5 new snow courses and 3 new soil moisture stations. A unique situation developed. The snow pack at low elevation was unusually heavy but the fiber glass electrodes lying beneath the snow in the soil indicated the soils were extremely dry, so dry that the soil could absorb the entire snow pack without allowing water to run into the streams. There was considerable discussion on the effect of this heavy snow pack at the low elevations.

A water supply forcast meeting was called by Bill Loughmiller, chairman of the Twin Falls Soil Conservation District board of supervisors, to discuss the situation for the 1955 season. Practically every resident in the Salmon Falls tract was represented at this meeting. Again an interpretation was made by the technicians of the Soil Conservation Service on the possibility of water for 1955. The forecast indicated that the snow pack would not contribute to streamflow because of the dry soil beneath it. While there was more than 2 feet of snow, carrying between 5 and 7 inches of water, the electrodes indicated that the dry soil would

absorb that much water.

The snow pack high in the mountains indicated a near normal snow cover, but again the electrodes indicated a very dry soil—soil that was dry for the second year in a row. An extremely low forecast was made for the coming summer. This time many operators within the district took drastic plans to conserve the short water supply available. Local technicians of the Service explained the many methods of conserving water on the farm. It is well known however, among the irrigators of southern Idaho that the farmers on the Salmon Falls tract make efficient use of their water every year and hence can make only small water savings by more economical use.

Carroll H. Dwyer and Vernon W. Baker, economists of the SCS at Porland, Oreg. recently completed a survey of the amount of work and money saved through the forecasts of 1955. Their survey brought out the following points:

The Salmon Falls tract contains about 70,000 acres which could be irrigated if adequate supplies were available. The available water supply fluctuates markedly however, from year to year depending upon the snow pack. The acreage actually irrigated varies from about 10,000 acres to 35,000 acres depending upon the watershed yield.

Heavy snows fell in the foothills in 1955 and March precipitation was 183 percent of normal. Visual evidence of hills covered by snow indicated to some people a good water supply, possibly adequate for about 25,000 acres. Lacking the water supply forecasts the farm operators would probably have prepared, pre-irrigated, and seeded the usual acreage. However, the water supply forecast based on snow surveys in the water-producing high mountains of the tract indicated runoff of only 60 percent of normal. Accordingly the farm operators reduced their anticipated acreage by more than one half.

In addition, the types and percentages of various crops planted were substantially different from those which would have been planted under a normal water supply. Crops requiring a late season water supply, such as alfalfa, or irrigated pasture were materially reduced or not planted at all.

The savings in farm operations resulting from not preparing the land and planting crops were estimated as follows:

Concrete-lined irrigation ditch of the Salmon River Canal Company.

Beans	$106,050
Small Grains	91,800
Hay or Pasture	101,550
	$299,400

Since these crops were not planted, there was a saving of approximately 6,600 acre-feet of water due to the fact that pre-irrigation of the anticipated crops was not done. This saved-water was used to supplement irrigation of land actually irrigated. Using average figures this water would normally produce a net income of $79,450.

In summation, the economic benefits which are readily evaluated in monetary terms for the Salmon Falls tract as a result of practical water supply forecasting in 1955 are estimated conservatively to be:

Expenses not incurred	$299,400
Increase in net income from saved water	79,450
Total benefits	$378,850

In addition to the monetary savings of the year, a good deal of land was left in productive covering and not prepared for seeding because there was no water available. This land was, therefore, not subject to wind and sheet erosion as it might have been if prepared for crop and allowed to go idle. These intangible benefits cannot be computed; nonetheless, they are very real.

In the future it seems that this high degree of cooperation between farm and range operators in the Twin Falls Soil Conservation District and local technicians of the Service will result in more efficient conservation and use of soil and water resources. The techniques of planning and cooperation developed in this area may well assist others in a similar situation throughout the Western States.

SNOW SURVEYORS AT WORK

(Excerpts from the reports of Walter C. Hankins, soil conservation aid, Soil Conservation Service, Twin Falls, Idaho.)

ON our March 1, 1955, measurements, John Pastoor, supervisor for the Twin Falls Soil Conservation District; Ellis Fuller, Twin Falls Soil Conservation District cooperator; and I left Twin Falls at 7 a.m. We planned to haul the M–7 snow-cat as far as Cherry Creek School, unload it, and drive the snow-cat to Pole Creek Goat Creek, and Hummingbird Springs snow courses—all of which are located along a ridge. Pole Creek is 18 miles south of Cherry Creek School and Hummingbird Springs 6 miles further south, with Goat Creek lying between.

We ran into difficulty shortly after reaching Roseworth Reservoir, which was still 22 miles short of Cherry Creek School. There was a cold, strong wind blowing and the road was practically drifted shut. After much shoveling, sweating, and swearing, however, we got the truck 10 miles farther, to Roland Patrick's ranch.

After talking with Mr. Patrick, we decided to unload the snow-cat and use it the rest of the way. We took our bed rolls, skis and poles, grub, parkas, sampling equipment, and everything else that makes a snow surveyor's existence possible, from the truck and tied them on the snow-cat.

In the meantime Mrs. Patrick prepared a delicious hot dinner for us. After eating, we started out, the M–7 looking more like a prospector's burro than an up-to-date over-the-snow machine.

We were glad we left the truck behind because the going got continually worse with great drifts in the road. However, there were patches, sometimes up to one-fourth of a mile, of bare ground and it was over these that the snow-cat had the most difficulty. The M–7 lacks several things, one of which is springs. Every rock it goes over makes itself known by a series of jolts, enough to jar one's backbone from one end to the other. We kept to the snow as much as possible but frequently there was nothing to do but to ride over the rocks.

Eventually we reached Cherry Creek School, left the main road and after a time reached

Walt Hankins

Pole Creek Ranger Station. At this point we decided to unload our bed rolls and most of the grub, and leave these at the station. It was not that we didn't trust the snow-cat, but it had developed a decided squeak in the left final drive bearing and the continuous jolting had caused the radiator to start leaking slightly. We thought that if the snow-cat quit on us, we could ski back to the station and be more comfortable. The going was better then. There was snow consistently enough that two of us could hang onto ropes and ski behind the snow-cat while the other man drove. The wind was getting steadily stronger, however, and it was cold.

We continued up the ridge, sometimes in timber and sometimes in the open. Our elevation was around 9,000 feet. We reached a point nearly even with and one-half mile away from the Goat Creek snow course. The snow there in the timber was fluffy and soft. Apparently it had not melted all winter, and the M–7 began sinking and wallowing along. Finally it stopped, having pushed enough snow in front of it with the front axle that it appeared unreasonable to try to make it go any further.

We took off on skis from this point just as the sun was sinking behind the Jarbidge Moun-

tains. We skied down to the Goat Creek snow course, measured it, then skied another 1½ miles to Hummingbird Springs and measured the snow there by flashlight.

After a 500-foot climb back to the ridgetop we returned to the snow-cat in darkness. The wind was getting stronger and was picking up snow and whipping it into new drifts. We started the snow-cat, shoveled enough snow that it could turn around, and started the return trip to Pole Creek Ranger Station.

After we left the timber and were driving along in the open, the situation did not look too pleasant. The wind had completely obliterated our tracks made on the way up and was whipping the snow to where visibility was cut to 50 feet or less. The M–7 is equipped with headlights, but when all you can see looking out the 18-inch square windshield is solid, glaring white, lights don't help much. It is easy enough to follow a ridge up hill but following a ridge downhill with secondary ridges branching off is a different story. To make matters more interesting, the left final drive bearing stopped squeaking and started howling. The cooling solution in the radiator became so low that the temperature gage began to register around 220°. When it reached the danger point, we shut off the engine, and sat there in the howling wind and opened some canned meat and ate lunch.

After some discussion and after the radiator cooled down, we decided to feel our way along the ridgetop, which we hoped was the right one. The snow-cat traveled for about 10 minutes and the radiator heated up again so we stopped again. As we sat there in the dark wondering whether to pull down off the ridge and try to find a sheltered place to spend the night, the wind let up momentarily and we were able to make out a group of coniferous trees shaped in such a way that we could recognize them as a point near a line fence which ran quite near to Pole Creek Ranger Station. After the engine cooled again, we made our way to this fence, and from there on into Pole Creek Ranger Station we had no further trouble except to stop occasionally to let the engine cool off.

As soon as we were in the Ranger Station we made a good fire, and before long enjoyed a hot supper. Early the next morning we measured the snow at the Pole Creek snow course, took the readings from the fiber glass electrode moisture units, and started the return trip to Cherry Creek School. From there we traveled west 14 miles to Kitty's Hot Hole, and then south 16 miles to Jarbidge, Nev. We then went 4 miles farther to the Fox Creek snow course and measured it. Since it was getting dark, we returned to Jarbidge and spent the night. The next day we drove the snow-cat 4 miles toward the Bear Creek snow course, skied 3 miles to reach it, measured the snow, and started back to Patrick's ranch where we had left the truck. We reached the ranch about 6 p.m. and loaded the snow-cat onto the truck. Having measured snow at all the snow courses in that end of our area, we then headed the truck back to Twin Falls.

During these 3 days we had driven the snow-cat about 148 miles over the most miserable type of terrain and in addition had skied 10 miles. The important thing, however, was that we had measured the snow at the 5 established snow courses, on schedule, and without serious damage to the M–7 snow-cat.

On January 31, 1955, at 6 p.m. John Pastoor, Twin Falls Soil Conservation District supervisor, Hal Cox, district forest ranger for the Humbolt National Forest, and I left Kitty's Hot Hole planning to spend the night at Mahoney Ranger Station. Normally this is about an hour's drive—16 miles up the Jarbidge River Canyon.

There was only 2 inches of snow at Kitty's Hot Hole, but before long we were bucking 10 inches of heavy wet snow. We reached Mahoney Ranger Station at 10 p.m. and were more than pleased to have a comfortable cabin in which to spend the night.

(Continued on page 189)

The snow surveyors of the Twin Falls Soil Conservation District reported that their January 1956 survey showed greatly improved moisture conditions over those of the previous 2 years. Soil moisture was excellent over most of the watershed. Surface snow averaged 38 inches in depth with a water content of 11 inches, while the snow averaged only 3.2 inches of water in 1955.

The Farmer and Wildlife Management

A preliminary, nontechnical report on the findings, to date, on the Patuxent Research Refuge for wildlife management.

By FRED H. DALE

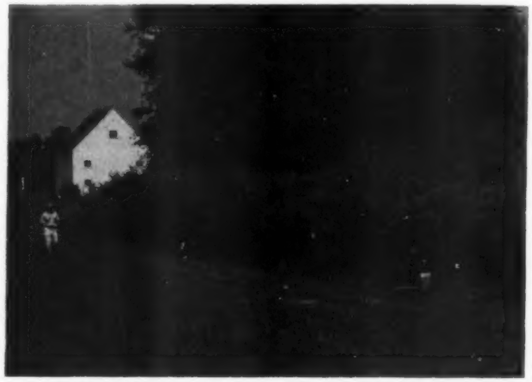
I ONCE asked a game technician in one of our progressive states, "Do you know how to manage land to produce more rabbits?"

"Yes," he replied, "but it's more profitable to farm."

I think this answer tells much about our way of thinking of wildlife on the farm. I believe the average farmer is a friend of wildlife. Many farmers go so far as to leave a row or two of corn unharvested as food for birds; others enjoy hunting or take pride in playing host to friends during the hunting season; and practically all farmers enjoy the whistle of a bobwhite, the song of a thrush, or the flash of a cardinal. The problem to many of them is, "How can I have more wildlife on my farm and still make a living as a farmer?"

The Fish and Wildlife Service and the Soil Conservation Service are both interested in this problem. The Fish and Wildlife Service realizes that more than 75 percent of small game animals shot in this country are produced on farmland, and that many of our migratory birds are farm residents; technicians of the Soil Conservation Service have nearly always tried to provide for wildlife in farm plans while advising farmers how to realize the most from management of the soil. Because of the interest of these two agencies, a research project was set up in 1947 at the Patuxent Research Refuge, near Laurel, Md., to try to find some needed answers.

The Fish and Wildlife Service furnished the land, labor for farming, and biologists to carry on the study. The Soil Conservation Service helped lay out the project, made conservation plans for both the conservation farm and the check area, and provided much of the planting materials. As the study has gone on, officials of SCS have visited the farms, advised about new problems, and used the area at times as a training site for farm planners.



Woods-field border on Patuxent demonstration farm.

From the start we projected our studies on the basis that there are probably three levels of wildlife management on which more facts are needed. First, there is the type that is good farming, aside from any effect it may have on wildlife. For example, if farmer Smith finds that a multiflora rose hedge will work better around a contour field boundary and will stay stock proof for a longer time than a wire fence, and that it helps reduce loss of soil moisture while serving as a windbreak, then he may be just as interested in the fence for good farming as for wildlife management. Contour hedges to mark field borders, woods-field borders to help hold back the spread of woods onto cultivated fields, and patches of cover that check erosion, all are good farm practices that might pay some extra dividends for wildlife.

The second level may be questioned by many farmers. Most of them, especially the best tillers of the soil, hate weeds. Every roadside, fence row, or small waste area on the farm is likely to be mowed or burned regularly to prevent weeds from getting started and spreading

Note.—The author is a biologist, U. S. Fish and Wildlife Service, Patuxent Research Refuge, Laurel, Md.

into cultivated fields. We know the farmer has a weed problem, but we also know that many wild creatures depend on weeds and other herbaceous plants for food and cover. We wondered whether there might not be some way to control weeds that would serve both good farming and wildlife management. Consequently, management of waste areas has been an important part of the study at Patuxent.

The third level of wildlife management studied is that which may actually decrease total farm income to a limited extent and will interest only a minority of farmers. Yet there are many farmers who like wildlife enough to want to do something more than good farming to encourage it. We often receive letters from farmers who want to know what can be done to increase quail, pheasants, rabbits, or songbirds on the farm. Many are from men who can afford to forego some of the productiveness of their land, if necessary, to encourage wildlife. As Federal agencies, we need to know how to advise such men, and should be able to say with some certainty what any given practice is likely to cost, and what wildlife responses may be expected. This part of the program is the last to be tried. As a matter of fact, we are still at the planning stage on many parts of it.

It should not be surprising that results on these studies have come slowly. The almost unbelievable speedup in industry in the last few years makes it hard for some of us to realize that most farm problems still come and go at a relatively slow pace. Man is in a hurry, but Mother Nature takes her time. It takes about 5 years to produce a multiflora rose fence that will turn livestock. After the fence is grown, several more years are needed to find out whether it will make a good fence, whether it will do anything for wildlife, and whether it will spread as a weed.

In spite of delays, waiting for nature, there have been some results that can be passed along now. This report is issued for three principal reasons: First, to advise farmers and technicians that such a study is being made; second, to report some promising results that make us believe we can help both farming and wildlife management on the farm; and, third, to point up some of the most important problems. We believe that many of our worst problems can be solved, once we learn to ask the right questions about them.

The conservation unit at Patuxent is laid out as a model farm. Probably no privately owned farm in Eastern United States demonstrates so completely the practices recommended by the Soil Conservation Service for soil and water conservation. Pastures have been improved by seeding to fescue and ladino clover, and by fertilizing; fences are of multiflora rose; contours are marked by hedges; woods-field borders are planted to shrub lespedezas; and water is drained off the slopes along sodded diversion terraces. Several planting materials are being tested along the contour hedges.

A check, or control unit set up for comparison, is farmed without much thought for either wildlife or soil conservation. This unit has wire fences, unimproved pastures, fields in large

Roadside cover and multiflora rose hedge on the Patuxent demonstration farm.

blocks, and in it there is no attempt to improve cover around field edges. Both units are managed on a 3-year rotation (corn, wheat, and hay); both are fertilized. However, we have been a bit more generous with fertilizer on the conservation farm than on the control.

As developments progressed, wildlife populations have been studied on both units. Songbirds and bobwhite quail have been counted each year. Rabbits, woodchucks, and other mammals about that size have been studied by live-trapping and marking with numbered tags. Even the small mammals such as mice and shrews have been trapped, given numbers, and released for further study. In this way we have been able to keep pretty close tab on what has happened to wildlife on the two units.

These two experimental farms are submarginal in soil resources. In Colonial days they were productive tobacco plantations, but as in many other areas along the Atlantic seaboard, so much of their original fertility was lost that they had been virtually abandoned as farms. From what we know of wildlife and soil fertility, we believe it will be hard to get best results from wildlife management measures on such depleted soils. Consequently, any favorable results probably would be magnified in good farming areas.

One discouraging feature of the first 5 or 6 years was the fact that the rabbits didn't seem to recognize what we were doing for them. We were able to take visitors over the farms and point out good patches of cover, beautiful living fences, well-growing hedges, in fact just about everything but rabbits! True, the conservation farm had more rabbits than the control unit, but not enough to make a farmer who had spent time and money developing it feel that he had made a good investment in terms of rabbit management.

During the first few years we followed the practice, common in many parts of the country, of mowing weeds in the fall, clipping all roadsides, and generally trying to keep the farm neat in appearance. We could see that this might result in too little cover for wildlife. Also, several packs of wild dogs roamed over the refuge night after night, and a heavy population of foxes hunted the fields. On winter mornings, dog and fox tracks were almost everywhere in the snow. With such a condition, it seemed that if predators could hold down a wildlife population anywhere, this would be the place. Then, as a third factor, many of the wildlife management plantings on the conservation farm had not matured. Some of the living fences were fairly good, but the double-row fences were still young. We thought we might have to wait a few more years for the development to bear fruit.

At this point we decided to "shoot the works" to see whether the rabbit population could be increased. It seemed good strategy to try several ideas at once and, if they were successful, to try later to find out which one was most effective rather than risk several more years in trying one thing after another. Consequently, we started a program of predator control, and at the same time began letting roadsides, fallow fields, and other waste areas grow up to natural cover. Meanwhile, of course, the wildlife management plants on the conservation farm progressed toward maturity. It would be hard to say which factor caused an increase in rabbits, or whether different factors worked together to reach the desired goal. At any rate, there was a decided jump in rabbit numbers on the study area.

Nature has many ways to confuse researchers, and sometimes it is pretty hard to separate what we have done from what Nature accomplishes by herself. We suspect that results will have to be discounted a bit because of a widespread increase in Maryland's rabbit population during the past year. Even after such a discount, however, it looks as if we were pretty successful on the conservation farm. Records indicate nearly a tenfold increase on that unit, as compared with no more than a threefold increase on the control farm. Probably the difference between the two units will be even greater in winter, since the control unit has almost no protective cover.

Some other developments may be of interest to farmers. Roadsides on the conservation farm have grown up largely to sericea lespedeza, which is rapidly crowding out some of our most pestiferous weeds. We do not know what the next step will need to be in rabbit management. But we think we can save a lot of unnecessary mowing, add good wildlife cover, and perhaps make real progress in weed control by merely easing up on intensive treatment of waste areas.

Wildlife plantings on an odd patch of the Patuxent demonstration farm.

We do not as yet know how hard it will be to control woody plants in these areas, but early results with selective use of herbicides are encouraging.

As to nongame species such as migratory birds, results have been good from the start. Multiflora rose fences are popular havens for mockingbirds. They seem to offer better winter homes than nesting places, yet quite a few have nested in the fences. For example, 39 mockingbirds were banded during the past summer along one of the fences. Ten of these were adults, seven nestlings, and the others juveniles. The total population of the conservation farm must have been considerably larger. Other birds that seem to profit especially from the fences include cardinals, towhees, indigo buntings, and even the blue grosbeak, which is not an abundant bird in this area. In short, the living fences and contour hedges have made a real contribution to bird life on the farm.

We have been interested in living fences, not only for their value in wildlife management but also for other values in the farm program. We cannot give a final report now on the multiflora hedge as a practical substitute for wire fences. From the first few years' study, however, it seems that the living fence may be a bit more expensive than wire to install, may require considerable fertilizing and care in the early years, and possibly will require some supplementary fencing in areas of poor soil or in unfavorable places. We believe, however, that once the fence is stock proof, it will provide a fence without maintenance for a longer period of time, is more easily installed around a curve, and will certainly add more to the beauty of the farm than wire. The blossoms in spring and red fruits in winter add touches of beauty thrown in gratis.

As to its threat as a weed, the rose will spread in some places if given a chance. We have no evidence, however, that it will become a severe pest if ordinary precautions are taken. There seems to be no danger that it will spread into a pasture, since cattle browse it back effectively. It offers no problem in a cultivated field that is plowed or disced every 2 or 3 years. In other places it may require some attention, but generally less than many other weeds which the farmer fights.

We are not ready to give final conclusions in this preliminary and nontechnical report. Two technical papers dealing with responses by birds are now in press and others will be prepared as we reach conclusions. We believe, however, that the farmer who wants to give some consideration to wildlife in his program will not need to sacrifice the efficiency of his farm to do so. Many of the things which we have done make a real contribution to the farm program; others save considerable labor and time. Good wildlife management depends first upon good land management, since soil fertility is basic for good wildlife populations.

SNOW SURVEYORS AT WORK

(Continued from page 185)

The next morning was cold and clear. We had a good breakfast in short order and were carrying our gear back to the truck when Hal Cox came into the cabin to say he had seen a mountain lion. John and I rushed out to the point of the hill where we could hear snarling and yowling. Approximately 200 yards away, we saw the cougar in the shadow of some sagebrush. After watching it awhile, we made enough noise to scare the cat and it ran up the hill. Another smaller mountain lion ran out of the brush and followed the first one.

We ran onto cougar signs nearly every trip into this area the rest of the winter, but did not see any more cats.

DISTRICT PROFILE

WILLARD COOK of ILLINOIS

Willard Cook

WILLARD COOK gave the Association of Illinois Soil Conservation Districts energetic, capable leadership in 1955 and was reelected for a second term as president. During his first term in office he devoted much of his time to visiting district boards of directors throughout the State, exhorting them to assume greater responsibility. He writes a letter to all district directors in the State periodically to inform them on current district operations and program improvements.

Willard's active interest in soil conservation has been evident throughout most of his life. A native of Mahaska County, Iowa, he recognized the importance of better soil management while helping with farm work during his youth. After 8 years of experience in industrial work in Chicago and vicinity, he rented a farm in McHenry County in 1934. He operated two other farms on a rental basis before purchasing the farm he now owns southwest of DeKalb.

He insisted on soil improving crop rotations and other conservation practices on the farm he operated even while he was a tenant. His farm is now rented on a fifty-fifty livestock share lease. While his DeKalb County farm is in the corn growing section of Illinois, he keeps a legume-grass meadow on as much land as is planted to corn. Small grain is used in the 5 year rotation to establish the meadow seedings.

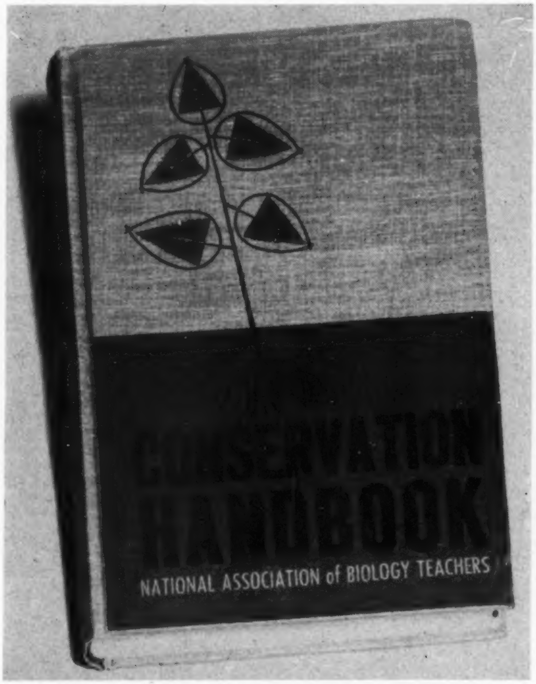
Cook has been a director of the DeKalb district since its formation. He is an ardent advocate of soil and water conservation education. He thinks that local people should do all they possibly can to help themselves. He believes, however, in asking for assistance from any authentic source to help with any problem that the local people are not equipped to handle. Willard recommends that local leaders handle as much of the districts' promotional work as possible in order to release SCS technical help for jobs requiring special training.

Willard and Mrs. Cook have two children—Barbara and Kenneth. Barbara, who was graduated from Adrian College, is secretary of the Children's Division, National Council of Churches. Kenneth, an Iowa State College graduate, received a M.A. degree from Garrett Biblical Institute. He has been ordained as an agricultural missionary. Kenneth, his wife and baby are now in Costa Rica where he is studying in preparation for work in Bolivia.

Both Cook and his wife are active workers in the Methodist Church. He is a member of the official board of the church. Willard also serves as county school trustee. He was a 4-H Club Leader for 11 years and has been identified with many agricultural and civic activities.

REVIEWS

HANDBOOK FOR TEACHING OF CONSERVATION AND RESOURCE-USE. By The National Association of Biology Teachers. 499 pp. Illustrated. 1955. Danville, Ill.: Interstate Printers and Publishers, Inc. $4.



THIS publication, financed partially by a grant-in-aid from The American Nature Association, was prepared during a 3-year period by the National Conservation Committee consisting of 11 regional chairmen, 48 state chairmen, and an advisory committee of 34 representatives of national conservation and education organizations. Dr. Richard L. Weaver, Conservation Department, School of Natural Resources, University of Michigan, served as chairman.

In addition to contributions from 200 teachers from 30 states showing how they have incorporated conservation and resource-use into their schools, special contributions from conservation agencies are also featured in this attractive and useful handbook.

The mass of well-organized and fully indexed material in the handbook is designed to help teachers get started on the important job of teaching conservation in both elementary and secondary schools. It is not a text but a *handbook* or *guide* to some of the outstanding examples of good conservation teaching in the United States. It contains many examples and illustrates the great variety of useful and successful methods and techniques available to teachers of conservation and resource-use.

Although particularly useful to biology teachers, the handbook should be a ready reference for professional conservationists who work with teachers and youth groups. The ultimate objective is the same for both groups—that conservation becomes a *way of life* with more and more people accepting the concepts of conservation and governing their lives accordingly.

The busy teacher will find much practical guidance in such chapters as: How Can I Start Teaching Conservation and Resource-Use?; What Can I Do to Extend Conservation Teaching to Other Parts of the School and to the Community?; How Can I Use the School Grounds in Teaching Conservation . . .?; and How Can I Use the Community in Teaching Conservation . . .?

The appendix contains, in addition to a 27-page list of free or inexpensive material for teaching conservation, an annotated list of 24 sound motion pictures and 124 filmstrips on conservation.

The handbook may be obtained through the office of Dr. Richard L. Weaver, Project Leader, P. O. Box 2073, Ann Arbor, Mich., with a 20 percent discount to schools. The proceeds will be used by the NABT Conservation Committee to continue its education activities in various states.

—ADRIAN C. FOX

WATER-RIGHT PRINCIPLES.—The State Supreme Court of Arkansas recently upheld the right of a fishing camp operator to enjoin irrigating farmers from pumping the level of a lake so low as to damage his fishing and boating business. The decision, delivered October 24, 1955, at Little Rock by Associate Justice Paul, recognized fishing and recreation as one of the lawful uses of water under riparian law.

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TWO NEW SCS MOVIES.—About a year ago five soil conservation district supervisors piled out of a car parked in front of the Agriculture Building in Washington, D. C. They marched into the building, down a flight of stairs, and through a door over which were white and red lights and a big warning sign—SILENCE—DO NOT ENTER WHEN RED LIGHT IS ON. They walked in, took off their coats, and went to work. Their job was to play the part of themselves in a new movie on watershed protection, "From The Ridge To The River."

Just about the same time a professional actor dressed in suntans was standing in the middle of a field on a nearby Maryland farm examining a tool strange to him, a soil auger. He was preparing to play the lead part of a soil surveyor in another new movie, "From The Ground Up."

These two color films are now available and can be obtained from Soil Conservation Service.

"From The Ridge To The River" tells the story of a small watershed, how it was plagued with floods and how the people in both the farming and city areas banded together to do something. You may find situations in this story similar to those you know firsthand. It is hoped that you do, for this film is intended to portray the important part small watersheds have in the prevention of floods. Dramatic action in the movie will hold your interest and that of the large TV audience it is hoped will see it. This film has been cleared for television. It is 26 minutes long.

"From The Ground Up" is the story of a soil surveyor who "is proud of his job." He describes his work in understandable terms and shows how it is important to the preparation of a conservation farm plan. This film was produced in cooperation with the National Plant Food Istitute. It is intended mainly for use in quarter hour television programs and has a running time of 13 minutes.

—ROBERT B. BRANSTEAD

NATIONAL LAND JUDGING CONTEST.—The 5th National Land Judging Contest will be held May 4, 1956, at the State Fairgrounds, Oklahoma City, Okla. This contest is sponsored by Station WKY AM-TV and businessmen of Oklahoma City. The 2nd National Range and Pasture Judging Contest will be held in conjunction with the land judging.

On May 3, a school of instruction will be provided for both the land and the range and pasture judging contests for all out-of-state participants who wish to make a study of soil and pasture conditions in Oklahoma.

The five divisions for contestants include: 4-H, FFA, women and girls, collegiate, and adults. Awards in the form of money, medals, trophies, and plaques will be presented the contest winners.

EROSION UNDER FURROW IRRIGATION

(Continued from page 179)

sion though the furrow flow continued at the same or greater rate.

The use of a large head at the beginning of an irrigation to get the water through and then making a final setting has some justification from the standpoint of irrigation efficiency and convenience. From the erosion standpoint, however, the surge of the large stream will cause excessive erosion. A good irrigation recommendation is that the initial stream be large enough to "get through in about one fourth of the time required for the irrigation." After the water gets through it is cut back to where it just reaches the end of the furrow and has very little runoff. This recommendation is a compromise between erosion control and irrigation efficiency.

Steep slopes are more vulnerable to erosion than the gentler ones. Under average irrigating conditions where the runoff from the end of the furrow is from 20 to 50 percent, reducing the furrow grade causes a distinct reduction in erosion. It also permits better distribution of moisture and increases absorption or intake. The gains from decreasing the furrow grade are offset somewhat by the greater flow required by the increased intake.